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THESIS

**JOINT OFFICER SUPPORTABILITY MODEL:
JOINT EDUCATION AND TRAINING
OF U. S. NAVY AVIATORS**

by

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March 1996

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JOINT OFFICER SUPPORTABILITY MODEL: JOINT EDUCATION AND TRAINING OF U. S. NAVY AVIATORS

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I. INTRODUCTION

A. PURPOSE

Now that the Department of Defense reduction in force structure approaches the designated cutbacks, an emphasis in maintaining the highest level of training and readiness must be enforced. Force structure management of personnel will require additional agility in maintaining exactly the necessary manpower needed for future contingencies. Today's national strategy is predicated upon all branches of the U.S. Armed Forces working jointly as a team to provide military power for numerous situations. These scenarios range across a vast spectrum, from peacekeeping to major regional conflicts. This new strategy will rely on the unique capabilities of each military service. Therefore, it is essential that future military leaders be educated and experienced in joint warfare. The former Chairman, Joint Chiefs of Staff, General Colin L. Powell stated in Joint Pub 1 that [Ref. 1]:

> When a team takes to the field, individual specialists come together to achieve a team win. All players try to do their very best because every other player, the team, and the home town are counting on them to win.

He went further on to say:

> But they all must also believe that they are part of a team, a joint team, that fights together to win.

This 1991 opening statement by the former Chairman provided the United States Armed Forces and its allies with the vision and strategy of how future conflicts will be conducted. An integral part of this team is the experience these joint officers bring to the battlefield. This team will require the capabilities from the air, land, sea, space and special forces to provide the required tools for the joint force commander. It is this versatility and flexibility that is essential to guarantee that this overwhelming force brings victory to the U.S. Armed Forces and it's allies.

The initial focus of this researcher will be to analyze the current process of producing this essential team member, a Joint Specialty Officer (JSO). The JSO is assigned to a multi-service or multi-national command that is involved in integrated employment or support of land, sea, and air forces, of at least two of the three Military Departments. These highly specialized and trained officers hold positions within the Joint Staff, the Office of the Secretary of Defense (OSD), and the Combatant Commands. The Secretary of Defense (SECDEF) is responsible for the development and publication of the Joint Duty Assignment List (JDAL) that currently consists of over 9,000 positions, of which 1,000 are designated critical positions. One of the problems that has concerned the joint staff in recent years is the reduction in the officer corps, while the JDAL continues to increase. This has reduced the ratio of qualified JSOs to billets and a small percentage of JDAL

billets are filled by officers not completely qualified according to the joint education and training requirements.

The United States Naval Officer profession provides an unquestionably unique and rewarding career that requires an exceedingly stringent and rigid training track as well as career path for each designator. Community managers, placement officers and detailers are responsible for ensuring that each officer is afforded the opportunity to perfect his/her war fighting skills and remain competitive for promotion. In addition each service is required to develop a cadre of Joint Specialists to fill JDAL billets. This additional joint education and training prerequisite often conflicts with operational assignments needed to remain competitive for future promotion. These joint requirements, based on the Goldwater-Nichols Department of Defense Reorganization Act of 1986 are specifically designed to enhance joint warfighting capabilities. Title IV of the Goldwater-Nichols Act specifically addresses joint officer management requirements and stipulates the required education, training, assignment and promotion for officers selected for joint duty.

B. OBJECTIVES

The primary objective of this thesis is to analyze the current joint education and training track for JSOs and model this process in a PC-based spreadsheet to provide joint officer managers a user friendly tool. The

aviation community will be the focus of this analysis. Future models can be expanded to include other warfare specialties and ultimately all officers within the joint arena. Some of the important aspects that will be considered during this analysis are as follows:

- Years of service and pay grade of officers within the joint education and training process.
- Transfer rates of officers from Joint Professional Military Education (JPME) to Joint Duty Assignment (JDA) or non-joint billet.
- Continuation, promotion and attrition rates for officers within the JSO education and training process.
- Several recognized JSO designation paths.
- Aviation Officer Professional Development Path and the entry points for joint education and training on that path.

Especially concerned with the supply side of the JSO production process, the number of available officers, JPME quotas and JDA billets will provide the system elements for analysis. In order to provide model flexibility due to modifications in existing laws and a dynamic military environment these elements will remain adjustable within the model. The model will be a PC-based spreadsheet using Microsoft EXCEL to provided joint officer managers and policy makers with an easy to use and versatile decision-making tool.

The remainder of this thesis will analyze the JSO production process and develop a suitable model in forecasting the number of JSO eligible officers. The second chapter will provide an overview of the current law,

requirements for producing joint officers and historical background. The third chapter will analyze the proposed model, while the fourth chapter will provide the results of this analysis. The final chapter will provide a summary, conclusions and recommendations for joint officer managers and future researchers of this topic.

II. JOINT SPECIALTY OFFICER DEVELOPMENT

A. BACKGROUND

The Goldwater-Nichols Department of Defense Reorganization Act of 1986 provided a wide range of organizational changes to improve the capability of the Military Services to implement successful joint military matters [Ref. 2]. Title IV specifically addresses joint officer personnel management requirements and stipulations for education, training, assignments and promotion for officers assigned to joint duty. Specific objectives were as follows:

- Enhance the joint war fighting capabilities of all the military services.
- Create a cadre of officers with education and experience in joint matters.
- Increase the quality of officers assigned to joint billets.
- Ensure that general/flag officers have significant experience in joint operations.

The proponents of the Goldwater-Nichols Act asserted that the military services did not operate mutually well together during World War II and Vietnam. During the Grenada conflict and the failed Iranian hostage rescue, Congress called for an examination on how the services could improve their inter-operability. The primary objective was to educate and train future general and flag officers to understand the operations and capabilities of the other services. During recent major conflicts, as well as future military

contingencies, Department of Defense (DoD) must rely on two or more services working together to defeat enemy opposition. This reorganization will allow future Major Regional Conflicts (MRC) to be lead by joint warriors.

To enhance the future warriors of tomorrow, Title IV provides guidance for the education and training of military members for joint service. A series of JPME courses have been designed to provide a basic knowledge and history of joint operations. In addition, hands-on training is provided by a tour to a JDA to provide on-the-job training to become familiar with the joint environment. Once the service member has completed his/her education and JDA, he/she is considered eligible to become a qualified JSO and can fill a critical billet. The joint education and training process of U.S. Navy aviators in becoming JSO eligible and the interaction with the Aviation Officer Professional Development Path will be a focus during this research.

B. JOINT EDUCATION

To provide a foundation of education, the JPME program is designed to educate and prepare military officers to become qualified JSOs. The Chairman, Joint Chiefs of Staff assists the SECDEF dealing in all matters concerning JPME, including the joint curriculums at the individual service schools. The Military Education Policy Document (MEPD) [Ref. 3] delineates the objectives and policies for the military education system for the U.S. Armed Forces. Joint education is divided into two stages, JPME Phase I

approximately a one year assignment, is awarded to students who complete the program at an approved service college. To achieve full credit for the joint education requirement a student must complete JPME Phase II at one of four colleges and one institute within the National Defense University (NDU) system. The mission of NDU is to ensure quality joint education for senior military officers, O-5 and above, in national security policy, national resource management and information resources management. Each institution provides specialized higher education and research in joint matters. The Armed Forces Staff College (AFSC), a three month program is designed for junior and senior military officers that have completed Phase I training at a service school. Both Phase I and II can be accomplished simultaneously at National War College (NWC), School of Information Warfare and Strategy (SIWS) and the Industrial College of the Armed Forces (ICAF). Each of these programs are approximately one year in length.

Phase I education provides a basic knowledge of military history, tactics, strategy and principles of war. Phase II continues to build on joint education with joint operations planning, execution, values and perspectives. One of the key highlights of Phase II is the requirement of students to work as action officers in a scenario driven joint planning process. This curriculum enables a military officer to assume a joint assignment with a framework of knowledge in joint planning and capability of each of the services in joint operations.

The education system is one of the major components in the JSO production process that can restrict the flow of qualified joint officers. Currently the Phase II education is limited to the amount of seats available for service members. Table 2.1 provides the annual JPME Phase II seats available for military members by institution and service during FY95.

	USA	USN	USAF	USMC	TOTAL
AFSC	264	167	299	48	778
ICAF	60	42	58	11	171
NWC	43	28	41	11	123
SIWS	4	2	4	1	11
TOTAL	371	239	402	71	1083

Table 2.1 Annual JPME Phase II Seats FY95

C. JOINT ASSIGNMENT

The Goldwater-Nichols Act requires that the Secretary of Defense define and publish a JDAL to provide joint billets to military officers. This list is comprised of over 9,000 critical and non-critical assignments. Current law requires that at least 1,000 JDAL billets are designated critical positions and that at least 50 percent of the total JDAL billets be filled with qualified JSOs at any one time. Critical joint positions must be filled by

Commander/Lieutenant Colonel (O-5) or above joint specialists who have demonstrated thorough joint experience, the ability to understand and operate in the joint environment. The remaining billets on the JDAL are classified as non-critical and can be filled by JSO qualified, JSO eligible or JSO-in-training service members, as long as the 50 percent JSO manning law is not violated. Table 2.2 provides a listing of JDAL positions by service and pay grade as of January 1996.

PAY GRADE	USA	USN	USAF	USMC	TOTAL
O-4	1191	749	1414	223	3577
O-5	1390	811	1433	239	3873
0-6	628	409	633	87	1757
0-7+	77	64	77	14	232
TOTAL	3286	2033	3557	563	9439

Table 2.2 JDAL by Service and Pay Grade

Ideally the joint cultivated military officer will then apply this education in a JDA to gain additional experience in the joint duty environment. A minimum of a three year tour is required in a joint assignment but this is waiverable to 24 months for Critical Occupational

Specialty (COS) officers. In the Navy, the majority COS officers are surface, submariner and aviator warriors. An additional requirement for a JDA billet is that the officer be of field grade rank O-4 or above.

Once an officer has completed the required JPME which encompasses approximately one to two years of educational training and successfully completed a joint assignment lasting a minimum of 24 months and up to 36 months, the officer's record goes before the individual service JSO board for consideration for a fully qualified JSO capable of filling a Critical Joint Duty Assignment (CJDA).

D. LITERATURE REVIEW

Attempts to model the JSO development and production process have been made in recent years by the Navy Personnel Research and Development Center (NPRDC) and the RAND institute. Hentschel [Ref. 4] wrote on NPRDC's development of the Joint Specialty Officer Modeling System (JSOMS), a management tool developed to analyze short and long-term effects of joint policy implementation. Military service personnel and billet inputs from the Officer Distribution Information System (ODIS) and the Joint Duty Assignment Management Information System (JDAMIS) provide the data required for JSOMS to analyze alternative policies prior to their implementation. This is a useful tool for the Navy's Joint Officer Manning Branch (PERS-455) of the Bureau of Naval Personnel in their planning and

management of naval officer careers. Some of the problems during the development of this model that limited its capability were the lack of historical data of career paths involved in joint education and duty, as well as the frequently changing laws between 1986 and 1990 that effected joint requirements.

The RAND institute is currently developing a JSO/JPME model [Ref. 5] to simulate how each service produces JSOs. The question of supportability has become a major concern for DoD during the recent downsizing of the force structure. The ability to adhere to the objectives of the Goldwater-Nichols Act has become increasingly difficult. The RAND model will support policy makers and joint officer managers by identifying the process by which JSOs are developed and providing a useful tool in simulating multiple policy scenarios in an ever changing environment.

Other researchers have investigated the effects of the Goldwater-Nichols Act on naval careers by using a modeling approach. In 1989 Johnson [Ref. 6] analyzed the effects on the Surface Warfare Officer (SWO) community by using a Markovian model named "FORECASTER" developed by Professor Milch [Ref. 7]. Johnson concluded that the use of personnel flow models is a valuable tool for assisting community managers in analyzing the impact of policy changes or career path restructuring. Later in that same year Drescher [Ref. 8] completed similar research on how the Goldwater-Nichols Act effected the career path of U.S. Navy aviators. His findings

concluded that an increase in back-to-back shore duty tours for mid-grade Lieutenant Commanders would be necessary to fulfill Goldwater-Nichols Act requirements.

III. MODEL

A. INTRODUCTION

This chapter is devoted to model specification and requirements needed to provide a method of forecasting the number of JSO eligible officers. The objective is to analyze the present JSO training track of U.S. Navy aviators in order to predict personnel flows through the system. This model represents the joint education and training policy as currently employed in accordance with the Goldwater-Nichols Act. Joint officer managers may make use of this model to forecast the number of JSO eligible officers based upon the input of officers to the joint education and training system. In addition, this model can be used to simulate policy changes within the system and demonstrate what effect this would have on the JSO production process.

One of the particularly challenging aspects for naval officers today is fitting several different careers into a single training path. Within the aviation community, officers are challenged in maintaining warfare specialty proficiency and monetarily motivated in achieving designated flight gates to retain maximum flight pay. In addition, surface warfare qualifications, subspecialties and joint duty can also serve to advance a naval aviator's career.

B. MODEL REQUIREMENTS

An analysis of interaction between aviation career path and joint officer education and training will begin by a review of the Aviation Officer Professional Development Path (Figure 3.1). When the Goldwaters-Nichols Act was first enacted in 1986, a few aviators were able to complete some of the joint education and training required as senior Lieutenants. Today the education process is exclusively reserved for officers of rank Lieutenant Commander or above who have completed their Department Head (DH) assignment. The rationale is to ensure that the limited education quotas are used for promotable and career minded officers. The appropriate time period appears at approximately the 13 year point. This has narrowed the window of opportunity for officers to be assigned to Phase I and II education and a joint billet. With a limited JPME school quota and restrictions on qualified individuals filling JDA positions the opportunity of entering the system has been reduced. The career path designates a two year period between DH tour and Command tour to engage in joint education and training. The next opportunity for joint education and training arises at the 19 to 20 year point, following a Command tour or fourth sea tour. The officer by this time has been promoted to Commander (0-5). Operational tours are extremely important within a career path since promotion and command assignments are based on officers' performance during these assignments.

AVIATION OFFICER PROFESSIONAL DEVELOPMENT PATH

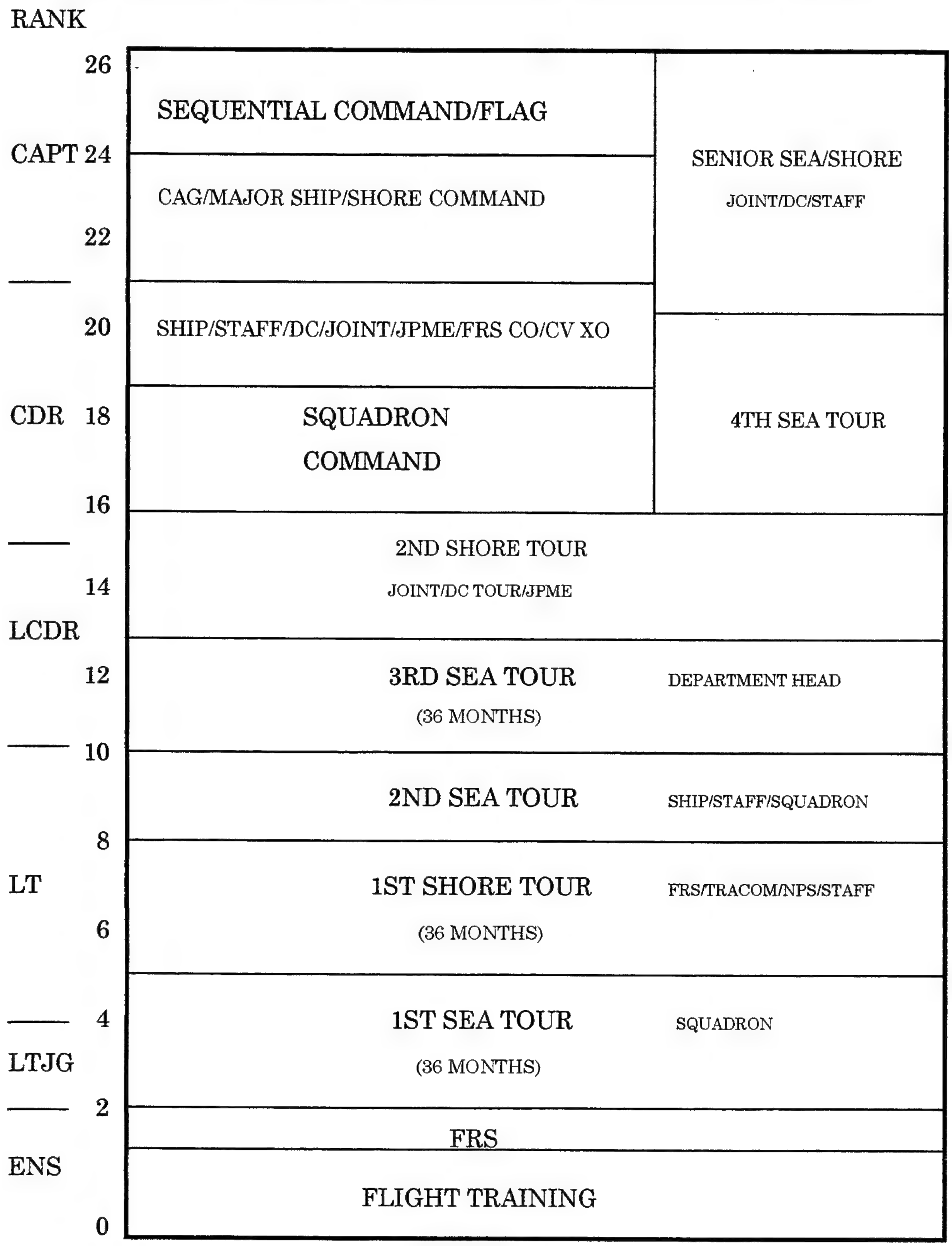


FIGURE 3.1

For the purpose of this thesis a JSO eligible officer refers to an individual who has completed Phase II joint education and completed or is currently assigned to a joint billet. This specialized joint education and training process can come in either sequence. The "preferred path" is the joint education followed by a joint assignment. The obvious reason here is to educate the officer prior to their training assignment. This path will be referred to as JSO path 1. A second route that leads to JSO eligibility is for an officer to complete a joint assignment followed by joint education. For officers within COS communities such as aviation, this JSO path 2 has been authorized without the requirement for a wavier from the SECDEF.

There is one additional path, the JDA to JDA route, that COS officers are authorized to utilize in order to become JSO eligible. This path is not considered in this research effort for three reasons. The two-joint-assignment-path requires a special wavier from the SECDEF and is limited to ten percent of the total selection during any service JSO board. In addition, only a few aviators in our data sample (see next chapter) qualified under this method. Figure 3.2 illustrates schematically the two primary routes that lead COS officers to JSO eligibility.

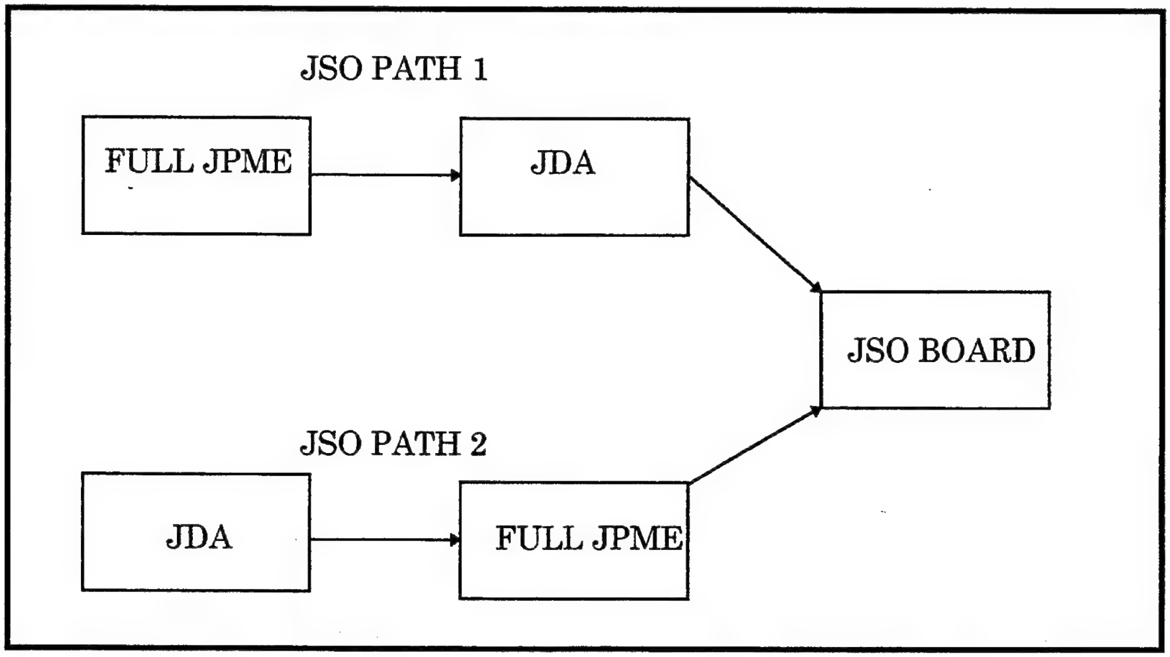


Figure 3.2. COS route to JSO eligibility

The joint education and training process to become qualified for JSO selection can take three to four years to complete. Phase I and II joint education requires approximately one year, while the JDA billet will require 24 to 36 months of an officer's time. Figure 3.3 exhibits in more detail some of the different routes put to use by COS officers to become JSO eligible within this system.

For the purpose of this research, all aviation assignments will be classified into three different billet types; (a) JPME, (b) JDA, and (c) Non-joint. All assignments which are neither JPME nor JDA will be considered non-joint billets. The three different assignments are illustrated within Figure 3.3.

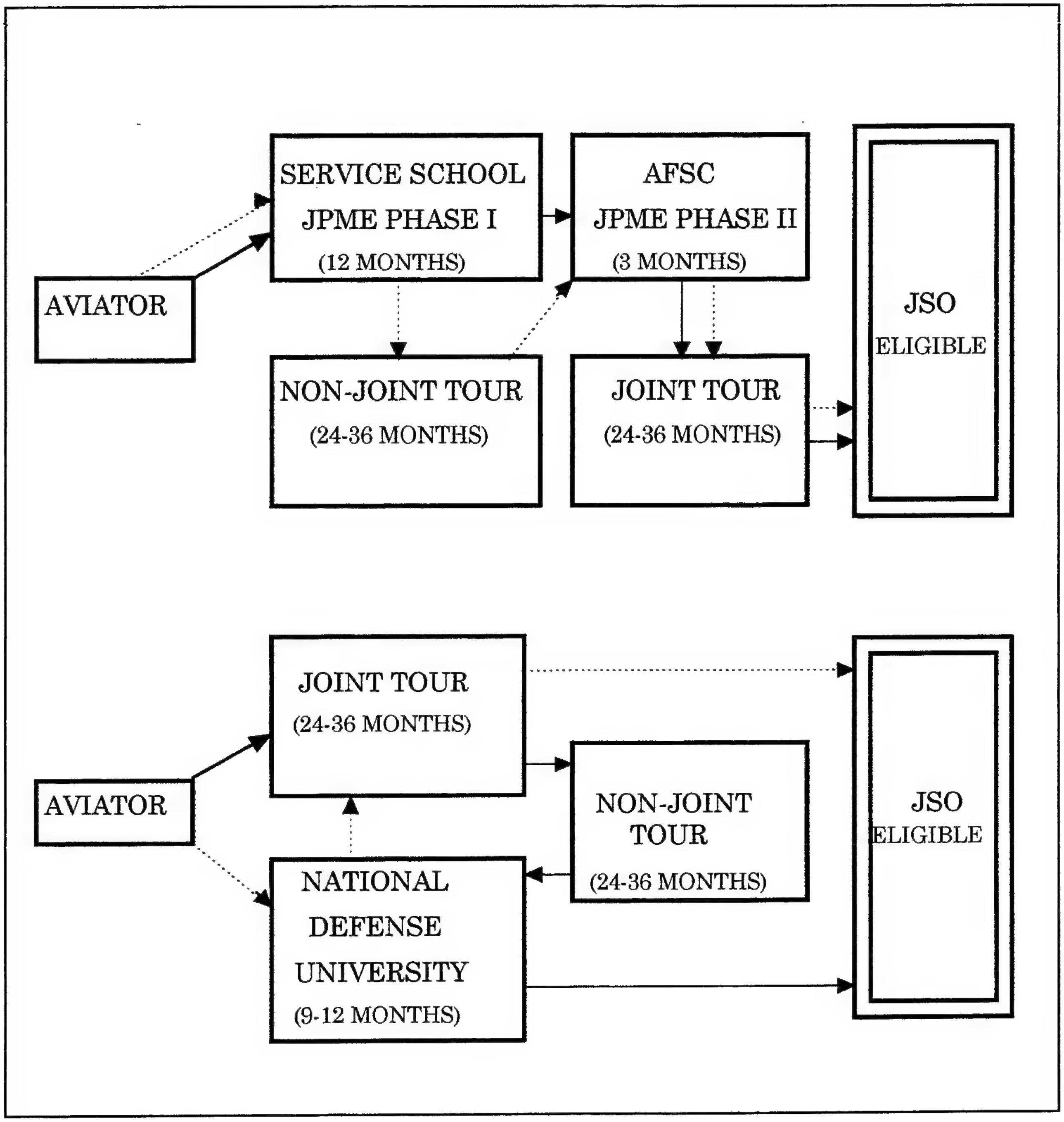


Figure 3.3 Routes to JSO Eligibility

C. MODEL FUNCTIONS

The primary purpose of this model is to forecast the number of JSO eligible officers among navy aviators using specific variables and rates. Since this joint education and training system will require a dynamic model to analyze the current process, Markov theory [Ref. 9] will be used to control variables such as rank, time in service and billet type. Markov chain analysis of the system will provide information derived from the stocks and flows of the joint education and training process of navy aviators as they progress through the system in becoming JSO eligible. The model uses a matrix format made up of 23 rows and 3 columns where the rows represent individual years of service (YOS) from nine through 31 YOS and the three columns represent the ranks of Lieutenant Commander (O-4), Commander (0-5) and Captain (O-6). Figure 3.4 shows the format of the basic matrix used within this model filled with accession data from FY95 navy aviators.

FY95 NAVY AVIATORS ACCESSIONS

YOS	LCDR	CDR	CAPT
9			
10	3		
11	4		
12	3		
13	20		
14	38	1	
15	9	5	
16	4	8	
17	2	1	
18		3	
19		9	
20		8	
21		4	4
22			6
23		2	2
24			1
25			4
26			3
27			6
28			3
29			
30			
31			

Figure 3.4 Basic Matrix Format

The following variables play a role in the model:

- Accessions
- Inventories
- Transition rates
- Continuation rates
- Promotion rates

1. Accessions

Accessions are the number of officers who enter the system at one time, either into joint education or a joint billet for the first time. The former will be derived from the number of navy aviators entering AFSC or NDU during the Fiscal Year (FY). The training input (JDAL billets) are the total number of navy aviators entering the system during the FY into their first JDA billet without previous assignment to JPME. Figure 3.5 illustrates the accession path.

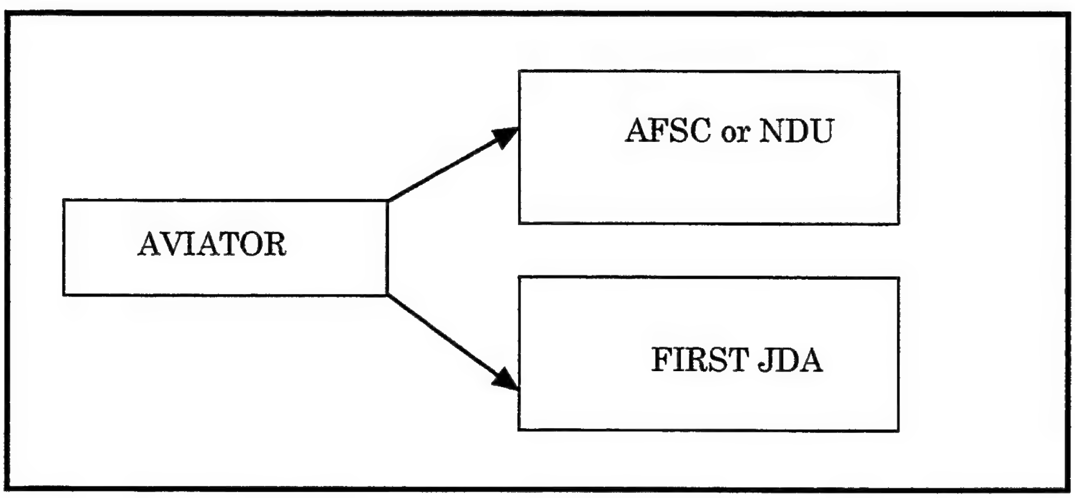


Figure 3.5 Accessions into the System.

2. Inventories

Inventories are the number of officers at a specified time during a FY by YOS, pay grade and billet type. For this model, this will be comprised of the number of officers by YOS, pay grade and billet type who are within the system at the designated time period. For this model the designated time periods will be FY91 through FY95. Inventories prior to FY91 were not available and for that reason they were not included in the model. These inventories are not necessary when forecasting future JSO production output and are only relevant when concerned with aggregate total number of JSOs. Even for such aggregate totals, the impact of the number of officers who entered the system prior to FY91 is becoming increasingly smaller in future years.

3. Transition Rates

Transition rates are the percentage of officers transferring from one assignment to another over the duration of a FY. Each of these assignments can be a joint education, joint duty billet or a non-joint billet. This principle of transferring from one assignment to the next is also depicted in Figure 3.3.

4. Continuation Rates

Continuation rates are the percentage of navy aviators by YOS and pay grade on active duty at the end of the FY who are still on active duty and in the aviation community at the end of the next FY. Attrition rates from the system is accounted for as the opposite of continuation rates. An officer transferring to a different designator or leaving active duty is considered attrition within this model. Figure 3.6 illustrates this concept.

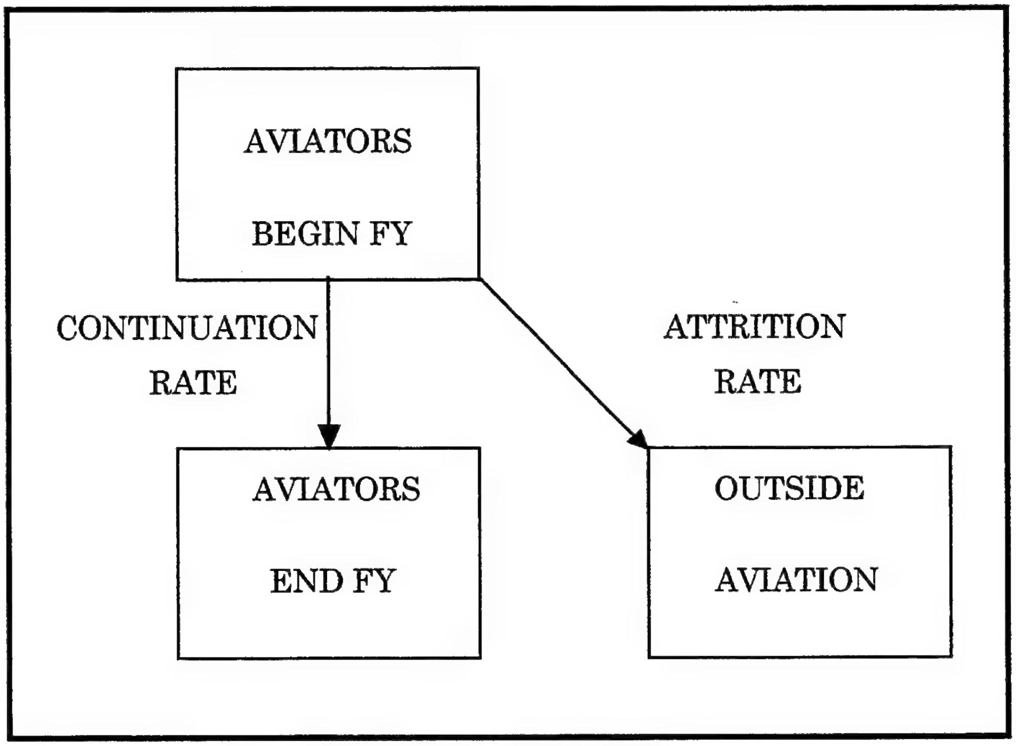


Figure 3.6 Continuation Rate

5. Promotion Rates

Promotion rates are the percentage of officers within a particular rank who are selected for the next higher rank and remain in the aviation community the next FY to be promoted. In this model aviation specific promotion rates are applied by YOS and pay grade. Figure 3.7 demonstrates this process.

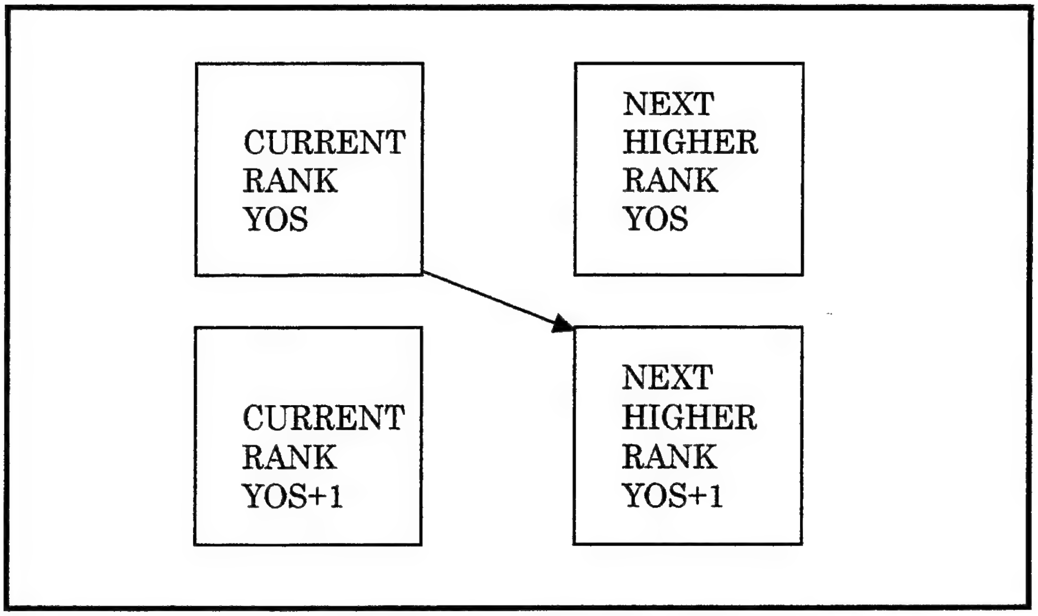


Figure 3.7 Promotion Rates

D. SYSTEM APPLICATION

The model is based on Markov analysis in that officers will move independently through the system over a specified time period. Each individual will be categorized based on YOS, pay grade and billet type within the basic matrix. Personnel flows through the system will be dependent on the transition, continuation and promotion rates as described in the previous section. The system begins with the current inventory of navy aviators within the JPME phase II assignments and JDA billets. The appropriate rates are then applied in order to transfer, age and promote officers as required. Each year new entrants into the system are also applied in the

form of accessions. These accessions are Lieutenant Commanders, Commanders and Captains who are entering Phase II joint education and/or joint assignment for the first time without prior attendance in JPME.

The following equation and definitions represent the Markov model for this system:

$$
\begin{aligned}
I(g, y, b, FY) = {} & I(g, y\text{-}1, b, FY\text{-}1)\ c(g, y\text{-}1)\ [1\text{-}p(g, y\text{-}1)] \\
& + I(g\text{-}1, y\text{-}1, b, FY\text{-}1)\ c(g\text{-}1, y\text{-}1)\ p(g\text{-}1, y\text{-}1) \\
& + I(g, y\text{-}1, b\text{-}1, FY\text{-}1)\ c(g, y\text{-}1)\ [1\text{-}p(g, y\text{-}1)]\ t(g, b\text{-}1) \\
& + I(g, y\text{-}1, b\text{-}2, FY\text{-}1)\ c(g, y\text{-}1)\ [1\text{-}p(g, y\text{-}1)]\ t(g, b\text{-}2) \\
& + I(g\text{-}1, y\text{-}1, b\text{-}1, FY\text{-}1)\ c(g\text{-}1, y\text{-}1)\ p(g\text{-}1, y\text{-}1)\ t(g\text{-}1, b\text{-}1) \\
& + I(g\text{-}1, y\text{-}1, b\text{-}2, FY\text{-}1)\ c(g\text{-}1, y\text{-}1)\ p(g\text{-}1, y\text{-}1)\ t(g\text{-}1, b\text{-}2) \\
& + A(g, y, b, FY)
\end{aligned}
\qquad (3.1)
$$

where:

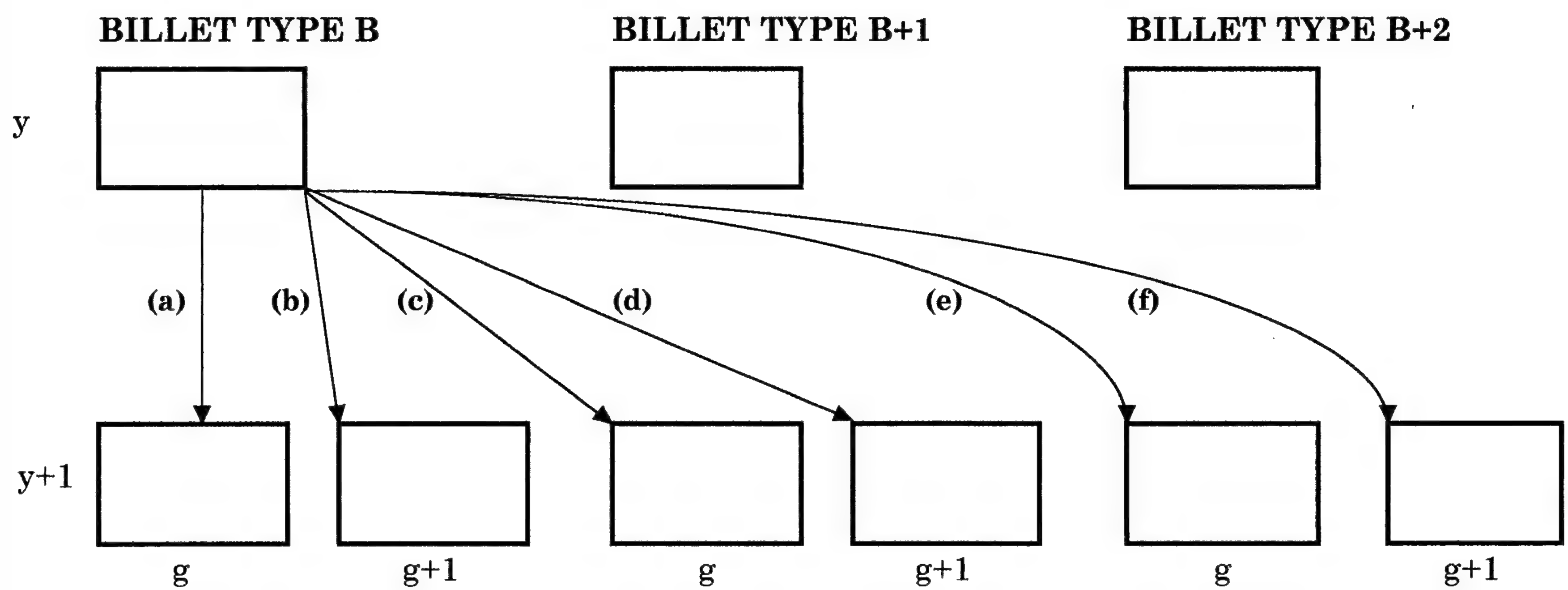
g = pay grade: 4, 5, 6
y = YOS: 9, 10, ..., 31
b = billet type: 1 = JPME, 2 = JDA, 3 = NON-JOINT*
FY = Fiscal Year: 91, 92, 93, 94, 95
I(g, y, b, FY) = number of officers in grade g, YOS y, billet type b at the end of fiscal year FY.
A(g, y, b, FY) = number of new officers (accessions) of grade g, YOS y who enter into billet type b during fiscal year FY.
c(g,y) = continuation rate of officers of pay grade g from YOS y to y+1.
p(g,y) = promotion rate of officers from pay grade g to g+1 when in YOS cells.
t(g,b) = transition rate of officers of pay grade g from billet type b to b+1.
1-t(g,b) = transition rate of officers of pay grade g from billet type b to b+2.

*Since b takes the value of 1, 2 and 3 only, the arithmetic with b must be understood in a circular fashion. For example, when b = 1, b-1 = 3 (instead of 0) and b-2 = 2 (instead of -1); or when b = 3, b + 1 = 1 (instead of 4) and b + 2 = 2 (instead of 5).

The Markov equation is used repeatedly to forecast inventories from one fiscal year to the next. The right-hand side of Equation (3.1) reflects the fact that there are, in general, seven different ways to arrive at an inventory cell defined by grade g, YOS y and billet type b at the end of fiscal year FY. The first six of these seven ways originate in an inventory cell characterized by YOS y-1 at the end of the previous fiscal year, FY-1:

(i) grade g and billet type b officers who continue (in the community) and don't get promoted to the next grade;
(ii) grade g-1 and billet type b officers who continue and do get promoted;
(iii) grade g and billet type b-1 officers who continue, don't get promoted, but transfer to billet type b;
(iv) grade g and billet type b-2 officers who continue, don't get promoted, but transfer to billet type b;
(v) grade g-1 and billet type b-1 officers who continue, do get promoted and transfer to billet type b;
(vi) grade g-1 and billet type b-2 officers who continue, do get promoted and transfer to billet type b;
(vii) new entrants (accessions) to the cell characterized by grade g, YOS y and billet type b during the fiscal year FY.

To assist the reader in understanding the three types of rates used in Equation (3.1), Figure 3.8 represents the three dimensional (YOS, pay grade, billet type) process that takes place within the model.



Explanation of rates along arrows:

(a) $c(g,y)\,[1-p(g,y)]$
(b) $c(g,y)\,p(g,y)$
(c) $c(g,y)\,[1-p(g,y)]\,t(g,b)$
(d) $c(g,y)\,p(g,y)\,t(g,b)$
(e) $c(g,y)\,[1-p(g,y)]\,[1-t(g,b)]$
(f) $c(g,y)\,p(g,y)\,t(g,b)$

where:

$c(g,y)$ = continuation rate of officers of pay grade g from YOS y to y+1.
$p(g,y)$ = promotion rate of officers from pay grade g to g+1 when in YOS cells y.
$t(g,b)$ = transition rate of officers of pay grade g from billet type b to b+1.
$1-t(g,b)$ = transition rate of officers of pay grade g from billet type b to b+2.

Figure 3.8 Model Functions

IV. ANALYSIS

A. DATA

The majority of data was obtained from the Joint Officer Management Office branch of the joint staff. The Joint Duty Assignment Management Information System (JDAMIS) data file tracks all U.S. military officers who have completed and qualified in a joint assignment and/or Phase II joint education billet. This information is considered complete and accurate after corroboration with Defense Manpower Data Center (DMDC) Officer Master File (OMF). Individual information for analysis provided as follows:

- Identification number
- Rank as of time entered into system
- Service school attended (as applicable)
    - Start and graduation date
- Next assignment
    - Joint or non-joint
- Joint Duty Assignment and billet code (as applicable)
    - Beginning and ending date
- Current active duty status
    - Date of inactive status (as applicable)

The data sample consisted of exclusively U.S. Navy aviator designators in pay grades 0-4 through 0-6 having served in some capacity within the joint education and/or training process between FY 1991 and FY 1995. The total sample numbered 921 officers. Table 4.1 provides a

record of the number of officers who entered the system within this five year period by pay grade and of the number among them who became JSO eligible during the period.

RANK	ENTRANTS	JSO ELIGIBLE
LCDR	240	56
CDR	405	117
CAPT	276	83
TOTAL	921	256

Table 4.1 Total Data Sample by Pay Grade and JSO Eligibility

Accurate continuation rates for officers are considered important for a successful forecasting model. For this model, continuation rates by YOS and pay grade were required for the Markov analysis. The rates were derived from the Officer Personnel Information System (OPIS) data file using beginning inventories and losses by YOS and pay grade between FY 1990 and FY 1994 for U.S. Navy aviators. Loss rates were calculated by dividing the number of losses by the beginning inventory of aviators each year, by YOS and pay grade. Continuation rates were then determined by subtracting the loss rate from one for each YOS and pay grade. Appendix A

provides the results of these calculations and the values used within the forecasting model.

Promotion rates used within this model were the average of the promotion rates for Commander or Captain of U.S. Navy aviators for FY93 through FY96. Both in-zone and above-zone rates were calculated for promotion to Commander and Captain. Below-zone rate data were not available and are considered inconsequential for this thesis. These rates were then applied (after continuation rates) to the inventories of the appropriate pay grade and YOS cell within the model. The in-zone promotion rates for Commander and Captain are .665 and .449, respectively. Above-zone promotion rates used within the model are .009 and .005 for Commander and Captain, respectively.

B. ANALYSIS

1. Transition Rates

Transition rates used for the forecasting model are by pay grade and billet type. These transition rates are computed as the number of officers moving from one assignment to another, compared to the total number of officers at the end of the previous FY in the first assignment. These rates, expressed here in percentages, are based upon the total sample for FY 1991 through FY 1995. The rationale for using the entire five year period versus

information based on yearly analysis is to average the data sample over a period for a more stable and reliable rate.

There are six cases of transition rates possible within this system to become JSO eligible. Table 4.2 provides the list of assignments types and transitions considered within this analysis.

SCENARIO		TRANSITION TYPE
	1	JPME to JDA
JSO PATH 1	2	JPME to NON-JOINT
	3	NON-JOINT* to JDA
	4	JDA to JPME
JSO PATH 2	5	JDA to NON-JOINT
	6	NON-JOINT** to JPME

* Previously served in JPME.
**Previously served in JDA.

Table 4.2 Transition Types

a. JPME to JDA (Scenario 1)

This scenario within JSO path 1 represents those officers who have taken the most efficient and frequented method to JSO eligibility. This scenario assures an officer of JSO eligibility by having completed joint education and moving directly to a joint assignment. This scenario also consists of officers that are assigned to a JDA and during that tour goes Temporary Assigned Duty (TAD) to complete the joint education requirement and returns to finish the JDA. Within the data sample, 62 percent of the navy aviators went directly to a joint assignment after completing Phase II

joint education. Table 4.3 provides the transition rates for officers going directly to a JDA following Phase II education based on pay grade for officers using JSO path 1.

PAY GRADE	JPME	to	JDA	TRANSITION RATE
LCDR	77		52	68%
CDR	163		105	64%
CAPT	124		69	56%
TOTAL	364		226	62%

Table 4.3 Transition Rates for JPME to JDA (Scenario 1)

b. JPME to NON-JOINT (Scenario 2)

The transition rates for those officers who entered the system by way of JSO path 1 and went to a non-joint assignment following a joint education tour instead of JDA would be the remainder of individuals. These officers would typically be required to return to operational sea tours in a normal sea-shore rotation. The JPME to non-joint assignment transition rates are displayed in Table 4.4.

PAY GRADE	JPME	to	NON-JOINT	TRANSITION RATE
LCDR	77		25	32%
CDR	163		58	36%
CAPT	124		55	44%
TOTAL	364		138	38%

Table 4.4 Transition Rates for JPME to NON-JOINT (Scenario 2)

c. NON-JOINT to JDA (Scenario 3)

Once an officer completes his/her non-joint assignment, the opportunity to return to a JDA billet and become JSO eligible exists. There is no time limit on when an officer might return to a joint billet to complete the training portion of the process. An assumption that is made for this particular model is that, if an officer returns for a JDA to become JSO eligible this will occur following one non-joint assignment. This presumption is based upon the Aviation Officer Professional Development Path (Figure 3.1) in that aviators are rotating between sea and shore assignments following the DH tour. Since the Goldwater-Nichols Act, this transition rate has been relatively low for individuals completing Phase II education, proceeding on to a non-joint tour and then returning to complete a JDA billet. Table 4.5 provides these transition rates by pay grade for the few officers who return to a JDA.

PAY GRADE	NON-JOINT to	JDA	TRANSITION RATE
LCDR	25	2	8%
CDR	58	6	10%
CAPT	55	5	9%
TOTAL	138	13	9%

Table 4.5 NON-JOINT to JDA Transition Rates (Scenario 3)

d. JDA to JPME (Scenario 4)

The second path available, especially designed for COS officers, allows these individuals to become JSO eligible with the experience to education path. A larger number of officers attempt to take this path to JSO eligibility with much less success. This is primarily due to the greater number of JDAL billets versus the limited number of JPME Phase II education quotas available and the fact that JSO path 1 is the preferred path. Over 60 percent of the officers in the sample are classified as JSO path 2 participants. Table 4.6 provides the transition rates for officers going directly from a JDA to JPME based on pay grade within JSO path 2.

PAY GRADE	JDA	to	JPME	TRANSITION RATE
LCDR	163		0	0%
CDR	242		3	1.2%
CAPT	152		2	1.3%
TOTAL	557		5	.9%

Table 4.6 Transition Rates for JDA to JPME (Scenario 4)

e. JDA to NON-JOINT (Scenario 5)

With less than one percent of the total sample going directly from a JDA to Phase II education, the only remaining chance of becoming JSO eligible comes from selections to return to Phase II education following a non-joint assignment. Table 4.7 illustrates the number and percentage of officers who transfer to non-joint assignments following a joint tour.

PAY GRADE	JDA	to	NON-JOINT	TRANSITION RATES
LCDR	163		163	100%
CDR	242		239	98.8%
CAPT	152		150	98.7%
TOTAL	557		552	99.1%

Table 4.7 Transition Rates for JDA to NON-JOINT (Scenario 5)

f. NON-JOINT to JPME (Scenario 6)

As it turns out few aviation officers return to complete joint education when JDA comes first. Less than three percent of the sample data that participated in JSO path 2 returned, within the five year period studied, to complete Phase II education and become JSO eligible. Table 4.8 depicts the return rates by pay grade of officers returning from a non-joint assignment to Phase II education to become JSO eligible.

PAY GRADE	NON-JOINT	to JPME	TRANSITION RATE
LCDR	163	2	1.2%
CDR	239	4	1.7%
CAPT	150	7	4.7%
TOTAL	552	13	2.4%

Table 4.8 Transition Rates for NON-JOINT to JDA (Scenario 6)

2. Regression Analysis

An analysis focused on the effect of becoming JSO eligible and any relationship of various explanatory variables was performed on the aviator data sample. To verify which path within the system had more of an effect on JSO eligibility, an Ordinary Least Squares (OLS) multivariate regression

analysis was performed to determine any significant difference between the two paths. Additional independent variables such as pay grade and whether the individual remained on active duty within the five year period were also considered as possible factors in becoming JSO eligible. The OLS model is specified by the following equation:

JSO ELIGIBLE = f(CDR, CAPT, PATH 1, ACTIVE DUTY)

The dependent variable was given the value 1 if the individual had completed both Phase II education and JDA using either path. Each of the independent variables is a dummy variable which takes on the value of 1 or 0. The independent variables are defined as follows:

- CDR is an individual whose pay grade was 0-5 when entering the system.
- CAPT is an individual whose pay grade was 0-6 when entering the system.
- PATH 1 is the education to joint assignment path.
- ACTIVE DUTY refers to individuals on active service as of 30 November, 1995.

The expected results were that each independent variable has a positive effect upon becoming JSO eligible for officers within the data sample. The variables CDR and CAPT were expected to have a positive effect due to the additional opportunities length of service provides to senior individuals. PATH 1 was expected to have a positive effect upon the dependent variable due to number of officers successfully becoming JSO

eligible via JSO path 1 compared to JSO path 2. ACTIVE DUTY was expected to be positive since these billets are typically reserved for officers with future potential of additional service. The results of the regression analysis are presented in Table 4.9.

VARIABLE	COEFFICIENT	t-VALUE
CDR	0.004	0.149
CAPT	-0.011	-0.385
PATH 1	0.624	27.79*
ACTIVE DUTY	0.024	0.819
n = 921	Rsq = 0.467	F = 201.033*
*significant at .05		

Table 4.9 Regression Analysis Results

Outcome from the regression analysis proved significant for one variable, PATH 1, as hypothesized. Two other variables, CDR and ACTIVE DUTY were not statistically significant, even though both have positive effects upon JSO eligibility as expected. The variable CAPT displayed a negative effect upon JSO eligibility, unlike originally hypothesized, but resulted as a not significant variable. This negative effect is likely due to the

relatively lower percentage of Captains becoming JSO eligible compared to the Commander pay grade. This in part is probably due to the few YOS remaining for the average Captain entering the system before retirement.

3. Career Path Comparison

Another objective in the analysis of this thesis was to compare system participants' career characteristics to the Aviation Officer Professional Development Path (Figure 3.1). The current career path for aviators provides several opportunities for an officer to participate in other activities outside of his/her warfare specialty throughout a 20 plus year career. For a Lieutenant Commander, this opportunity exists following a DH tour at the 13 year point. For selected officers this affords an ideal opportunity to venture outside their community and attend joint education and/or a joint assignment. Similar opportunity for a Commander comes following the Command tour or fourth sea tour, at about the 19 to 20 year point. Table 4.10 provides the entry point into the system by pay grade in average years of service for the overall system and each path.

PAY GRADE	PATH 1	PATH 2	OVERALL
LCDR	13.23	12.68	12.86
CDR	16.08	16.44	16.29
CAPT	21.85	22.70	22.32

Table 4.10 Entry Point into the System by YOS and Pay Grade

The actual entry point of Lieutenant Commanders into the system is approximately the 13 year point. When compared to the Aviation Officer Professional Development Path, this is the expected YOS for a Lieutenant Commander following a DH tour. However, for the Commander pay grade an unanticipated average YOS entry point of about 16 does not agree with the standard aviator career path. Several explanations for this anomaly are plausible. Officers not selected for a command tour are given the opportunity to become a JSO, as an alternative career subspecialty. Another possibility is that there is some additional time within the career path prior to the command tour or fourth sea tour for a joint education and/or joint assignment. Further analysis would be required to determine the exact cause why Commanders entering the joint education and training system appear to be misaligned with the Aviation Officer Professional Development Path (figure 3.1).

C. MODEL RESULTS

The PC-based spreadsheet model was run using the actual data for U.S. Navy aviators who entered the joint education and training system between FY91 and FY95 to verify the research methodology of this thesis and model. Table 4.11 presents the comparison of the forecasted results versus the actual number of JSO eligible officers as provided by the data. When compared to the actual number of JSO eligible officers produced within the aviation community for the five year period, the model forecast came within two percent of the total number. The discrepancy between forecasted and actual number for individual pay grades can be attributed for example, to the sample data not accounting for promotion of individuals after entering the joint education and training system. The sample data provided the pay grade at the time when the individual entered the system.

PAY GRADE	MODEL	ACTUAL
LCDR	66	56
CDR	122	117
CAPT	71	83
TOTAL	259	256

Table 4.11 Model Versus Actual Number of JSO Eligible Officers

In addition, the differences between the forecasted and the actual number of JSO eligible officers by pay grade can also be attributed to the continuation rates used for each rank. The forecasting model used continuation rates that were specific to aviators throughout the navy. Aviators within the joint education and training system may behave somewhat differently from the majority of aviators. This same reasoning can apply to promotion rates as well. As a result it appears that the model is sometimes overestimating at other times underestimating the pay grade totals.

Appendix B provides a Model User's Guide to assist joint officer managers and/or future researchers in the application of the PC-based spreadsheet. The Model User's Guide provides an explanation of each spreadsheet and its function within the forecasting tool.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The objective of this thesis was to analyze the U.S. Navy aviator JSO production process and develop a forecasting model to predict future JSO eligible personnel flows. In addition, the results may serve as a basis for future research in the development of a JDAL supportability model for all U.S. military services.

The goal of the PC-based spreadsheet model constructed here is to assist the Joint Officer Management Office of the Joint Staff and Bureau of Naval Personnel, PERS-455 branch in forecasting future numbers of JSO eligible officers. More than providing the actual numbers, however, the most important aspect of this thesis was to devise a methodology by which future research may be conducted to construct a more comprehensive model of JSO production.

The analysis considered two separate and approved paths to JSO eligibility. The first path, designated JSO path 1, is the "preferred path" since officers complete their joint education prior to joint assignment. This path is constricted due to the limited number of Phase II education quotas available to service members. The second path examined allows officers to serve on a joint assignment first and complete their joint education at a later time to become JSO eligible.

B. CONCLUSIONS

This analysis provided overwhelming evidence that the primary method in becoming JSO eligible taken by navy aviators is the JPME to JDA path. This path was used by 40 percent of the five year (FY91-FY95) sample of navy aviators. Of those who entered the system by this path, 62 percent went directly from JPME phase II education to a joint assignment. Of the remaining 38 percent that went to a non-joint assignment from JPME, only 9 percent have hitherto returned to a JDA to become JSO eligible. The overall production rate is 66 percent for the participants who enter the JPME to JDA path. When looking at the entire joint education and training system, this path produces 93 percent of the JSO eligible officers.

The second path available within the system is JDA to JPME path, where officers enter the system by assignment to a joint billet within the JDAL. The majority of the officers, 60 percent of our data sample, fit within this category. However, hitherto less than three percent of those officers has completed the joint education requirement as well. The conclusion is that the vast majority of officers entering the system by way of this path probably never returns to complete the joint education requirement. Still, this secondary path does allow for some flexibility within the joint education and training process when an education quota is not immediately available. Even though this path is rarely completed by those who embark on it, this path also helps in fulfilling requirements within the JDAL and allows

officers to return to their career path after a brief stint within the joint warfare arena. In addition, this path does provide a large pool of quality officers who have completed their two to three year long JDA, thus all that remains for these officers is to complete the required joint education. This could be useful if an urgent need of significantly higher number of JSOs would arise.

The majority of the officers participating in the joint education and training process are Commanders, which also happens to be the largest grade requirement on the Navy's JDAL. These Commanders are beginning their joint education and training at the 16 year point in their career. This conflicts with the normal aviation career path, where a typical commander begins an aviation command tour or their fourth sea duty at approximately this point in time.

This analysis of the aviation members of the JSO production system seems to suggest that the joint education and training system is working as designed by educating the majority of officers prior to serving in a joint billet and creating a pool of JSO eligible officers to become qualified JSOs as required.

C. RECOMMENDATIONS

Aviation community managers are interested in what the effects of becoming JSO eligible are on an officer's career and if this has a positive effect on promotability. Another question might be, whether there is a difference within the aviation sub-communities in their approach in producing JSO eligible aviators. These are all valid areas of concern not examined during this research, yet deserve some analysis for future consideration.

Following an evaluation by the Joint Staff and Bureau of Naval Personnel, Joint Officer Management Offices, modifications and further development of JDAL supportability models will be required. As previously stated, one of the advantages of this PC-based spreadsheet model is the flexibility and adaptability for modifications. As required, this model can be modified to incorporate other warfare specialties and designators within the U.S. Navy or even other military services may be included in a similar model.

Finally, if this methodology and spreadsheet is adopted for future use as a forecasting tool, consideration should be give in the development of a mainframe interface with the JDAMIS data file. This would supply the required information to maintain the most current data available for the joint officer managers and policy makers. Officer inventories, accessions, transition, continuation and promotion rates by service and community will,

of course, require periodic updates in order to maintain a viable forecasting tool.

APPENDIX A

Continuation Rates

YOS	LCDR	CDR	CAPT
9	1		
10	1		
11	.98		
12	.965		
13	.962		
14	.974	1	
15	.967	1	
16	.864	.998	
17	.874	.991	
18	.852	.981	
19	.687	.932	
20	.165	.847	1
21	.475	.841	.952
22	.815	.687	.997
23	.708	.584	.982
24		.590	.906
25		.504	.834
26		.159	.690
27			.670
28			.702
29			.704
30			.284
31			

APPENDIX B

MODEL USER'S GUIDE

A. INTRODUCTION

The Joint Specialty Officer Forecaster (JSOF) model provides an interactive forecasting tool for joint officer managers in predicting the number of JSO eligible officers given the size of input to the joint education and training system. This model will calculate the number of officers by YOS and pay grade who are consider eligible to become qualified JSOs based on the current guidelines. The model consists of numerous 21 by 3 matrixes using Markov analysis to age the force structure as required by use of applicable continuation, transfer and promotion rates.

The JSOF model is a spreadsheet application designed on Microsoft Excel software. User may refer to Microsoft Excel user's guide for spreadsheet related details. This Model User's Guide will discuss the JSOF's initial setup and capabilities as currently programmed.

B. MODEL FUNCTIONS

The model was designed for the aviation community in forecasting the number of JSO eligible officers based on FY91 through FY95 data received from the JDAMIS file.

The model makes use of the following variables:

- Inventories
- Accessions
- Continuation rates
- Transition rates
- Promotion rates

Further discussion and description of the above items can be found in Chapter Three of this thesis.

The spreadsheet model has been built within a single workbook on seven separate sheets labeled as follows:

- FY INPUT
- PATH 1
- PATH 2
- FORECAST
- CONTINUATION
- PROMOTION
- TRANSITION

The remainder of this Model User's Guide will discuss the function of each sheet and how each sheet relates to forecasting the number of JSO eligible officers within the U.S. Navy aviation community. Examples of the output of this model are provided at the end of this Appendix.

1. FY INPUT

This sheet provides the input for each FY by YOS and pay grade for the number of individuals who enter the joint education and training system. PATH 1 refers to individuals who have entered the system via JPME during that FY. PATH 2 presents the individuals who have entered the system by assignment to a JDAL billet. These yearly accessions are then applied to their respective PATH 1 or PATH 2 spreadsheets.

2. PATH 1

This spreadsheet provides the calculations using the yearly accession input from FY INPUT. Continuation, transition and promotion rates are applied as required by individual YOS and pay grade. As explained in Chapter Four of this Thesis, officers will go to one of two assignments from JPME: either directly to a JDA or a non-joint billet. This is determined by the transition rates for each situation. There are three different matrixes where an individual can be assigned by YOS and pay grade; DIRECT TO JDA, NON-JOINT or RETURN TO JDA, determined by the transition rates and time spent in various assignments. The final year in this sheet is a total of the preceding years that is then applied to the FORECAST sheet to total all years and paths.

3. PATH 2

This spreadsheet operates in a similar fashion to the PATH 1 sheet. It takes into account those individuals who enter the joint education and training system by a JDA. There are three different matrixes where an individual can be assigned by YOS and pay grade; DIRECT TO JPME, NON-JOINT or RETURN TO JPME, determined by the transition rates and time spent in various assignments. Again, the final year is a total of the preceding years that is then applied to the FORECAST sheet to total all years and paths.

4. FORECAST

This spreadsheet provides a summation of both PATH 1 and PATH 2 calculations by YOS and pay grade. The forecast is a total number of JSO eligible officers for the end of the specified FY.

5. CONTINUATION

This sheet provides the individual continuation rates by YOS and pay grade that are applied to the PATH 1 and PATH 2 spreadsheets.

6. PROMOTION

This sheet provides the individual promotion rates by YOS and pay grade that are applied to the PATH 1 and PATH 2 spreadsheets.

7. TRANSITION

This sheet provides the individual transition rates by YOS and pay grade that are applied to the PATH 1 and PATH 2 spreadsheets.

(FY95)

YOS	PATH 1 LCDR	PATH 1 CDR	PATH 1 CAPT
9	1	0	0
10	1	0	0
11	4	0	0
12	6	0	0
13	6	0	0
14	12	2	0
15	4	9	0
16	0	13	0
17	0	4	0
18	2	5	0
19	0	6	0
20	0	4	0
21	0	2	5
22	0	0	5
23	0	1	2
24	0	1	1
25	0	0	2
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0

YOS	PATH 2 LCDR	PATH 2 CDR	PATH 2 CAPT
9	1	0	0
10	3	0	0
11	4	0	0
12	3	0	0
13	14	0	0
14	21	0	0
15	6	4	0
16	3	7	0
17	2	0	0
18	0	3	0
19	0	4	0
20	0	6	0
21	0	3	3
22	0	0	3
23	0	1	1
24	0	0	1
25	0	1	3
26	0	0	3
27	0	0	6
28	0	1	2
29	0	0	0
30	0	0	0
31	0	0	0

PATH 1

FY (96)

DIRECT TO JDA

YOS	LCDR	CDR	CAPT
9	0	0	0
10	1	0	0
11	1	0	0
12	3	0	0
13	7	0	0
14	6	0	0
15	17	7	0
16	16	15	0
17	4	15	0
18	2	20	0
19	2	16	0
20	0	14	0
21	0	9	1
22	0	6	7
23	0	0	12
24	0	1	13
25	0	0	8
26	0	0	7
27	0	0	4
28	0	0	2
29	0	0	1
30	0	0	0
31	0	0	0

NON-JOINT

YOS	LCDR	CDR	CAPT
9	0	0	0
10	0	0	0
11	0	0	0
12	1	0	0
13	3	0	0
14	3	0	0
15	5	3	0
16	4	9	0
17	1	9	0
18	0	11	0
19	1	9	0
20	0	8	0
21	0	15	1
22	0	17	5
23	0	1	9
24	0	0	10
25	0	1	7
26	0	0	6
27	0	0	3
28	0	0	1
29	0	0	1
30	0	0	0
31	0	0	0

RETURN TO JDA

YOS	LCDR	CDR	CAPT
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	1	0
18	0	1	0
19	0	1	0
20	0	1	0
21	0	0	0
22	0	0	1
23	0	0	1
24	0	0	1
25	0	0	1
26	0	0	1
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0

PATH 1

FY (96) YOS	DIRECT TO JPME			NON-JOINT			RETURN TO JPME		
	LCDR	CDR	CAPT	LCDR	CDR	CAPT	LCDR	CDR	CAPT
9	0	0	0	0	0	0	0	0	0
10	0	0	0	1	0	0	0	0	0
11	0	0	0	4	0	0	0	0	0
12	0	0	0	12	0	0	1	0	0
13	0	0	0	9	0	0	1	0	0
14	0	0	0	22	0	0	2	0	0
15	0	0	0	34	21	0	1	0	0
16	0	0	0	9	35	0	0	0	0
17	0	0	0	4	30	0	0	1	0
18	0	0	0	3	16	0	0	1	0
19	0	0	0	2	12	0	0	4	0
20	0	0	0	1	23	0	0	3	0
21	0	0	0	0	20	7	0	1	0
22	0	0	0	0	10	20	0	0	1
23	0	0	0	0	0	21	0	0	1
24	0	0	0	0	1	7	0	0	3
25	0	0	0	0	2	13	0	0	1
26	0	0	0	1	1	9	0	0	2
27	0	0	0	1	0	8	0	0	1
28	0	0	0	0	0	8	0	0	0
29	0	0	0	0	1	3	0	0	0
30	0	0	0	0	0	1	0	0	0
31	0	0	0	0	0	0	0	0	0

FORECAST

FY 96		LCDR			CDR			CAPT		
		PATH1	PATH2	TOTAL	PATH1	PATH2	TOTAL	PATH1	PATH2	TOTAL
YOS	9	0	0	**0**	0	0	**0**	0	0	**0**
	10	1	0	**1**	0	0	**0**	0	0	**0**
	11	1	0	**1**	0	0	**0**	0	0	**0**
	12	3	1	**3**	0	0	**0**	0	0	**0**
	13	7	1	**8**	0	0	**0**	0	0	**0**
	14	7	2	**9**	0	0	**0**	0	0	**0**
	15	17	1	**18**	7	0	**7**	0	0	**0**
	16	16	0	**17**	15	1	**16**	0	0	**0**
	17	4	0	**4**	16	2	**18**	0	0	**0**
	18	2	0	**3**	22	1	**23**	0	0	**0**
	19	2	0	**2**	17	4	**21**	0	0	**0**
	20	0	0	**0**	15	3	**18**	0	0	**0**
	21	0	0	**0**	9	1	**10**	1	0	**2**
	22	0	0	**0**	6	0	**6**	7	1	**9**
	23	0	0	**0**	0	0	**0**	13	1	**14**
	24	0	0	**0**	1	0	**2**	14	3	**16**
	25	0	0	**0**	0	0	**0**	9	1	**11**
	26	0	0	**0**	0	0	**0**	8	2	**10**
	27	0	0	**0**	0	0	**0**	4	1	**5**
	28	0	0	**0**	0	0	**0**	2	1	**2**
	29	0	0	**0**	0	0	**0**	1	0	**1**
	30	0	0	**0**	0	0	**0**	0	0	**1**
	31	0	0	**0**	0	0	**0**	0	0	**0**
		59	7	**66**	109	14	**122**	59	12	**71**

FORECAST

TRANSITION

DIRECT

	PATH 1		
YOS	LCDR	CDR	CAPT
9	0.68		
10	0.68		
11	0.68		
12	0.68		
13	0.68		
14	0.68	0.64	
15	0.68	0.64	
16	0.68	0.64	
17	0.68	0.64	
18	0.68	0.64	
19	0.68	0.64	0.56
20	0.68	0.64	0.56
21	0.68	0.64	0.56
22		0.64	0.56
23		0.64	0.56
24		0.64	0.56
25		0.64	0.56
26		0.64	0.56
27		0.64	0.56
28			0.56
29			0.56
30			0.56
31			0.56

	PATH 2		
YOS	LCDR	CDR	CAPT
9	0.01		
10	0.01		
11	0.01		
12	0.01		
13	0.01	0.01	
14	0.01	0.01	
15	0.01	0.01	
16	0.01	0.01	
17	0.01	0.01	
18	0.01	0.01	
19	0.01	0.01	0.01
20	0.01	0.01	0.01
21	0.01	0.01	0.01
22		0.01	0.01
23		0.01	0.01
24		0.01	0.01
25		0.01	0.01
26		0.01	0.01
27		0.01	0.01
28		0.01	0.01
29			0.01
30			0.01
31			0.01

TRANSITION

TRANSITION

NON-JOINT

YOS	PATH 1 LCDR	PATH 1 CDR	PATH 1 CAPT
9	0.32		
10	0.32		
11	0.32		
12	0.32		
13	0.32		
14	0.32	0.36	
15	0.32	0.36	
16	0.32	0.36	
17	0.32	0.36	
18	0.32	0.36	
19	0.32	0.36	0.44
20	0.32	0.36	0.44
21	0.32	0.36	0.44
22		0.36	0.44
23		0.36	0.44
24			0.44
25			0.44
26			0.44
27			0.44
28			0.44
29			0.44
30			0.44
31			0.44

YOS	PATH 2 LCDR	PATH 2 CDR	PATH 2 CAPT
9	0.99		
10	0.99		
11	0.99		
12	0.99		
13	0.99	0.99	
14	0.99	0.99	
15	0.99	0.99	
16	0.99	0.99	
17	0.99	0.99	
18	0.99	0.99	
19	0.99	0.99	0.99
20	0.99	0.99	0.99
21	0.99	0.99	0.99
22		0.99	0.99
23		0.99	0.99
24			0.99
25			0.99
26			0.99
27			0.99
28			0.99
29			0.99
30			0.99
31			0.99

TRANSITION

TRANSITION

RETURN

YOS	PATH 1 LCDR	PATH 1 CDR	PATH 1 CAPT	PATH 2 LCDR	PATH 2 CDR	PATH 2 CAPT
9	0.08			0.012		
10	0.08			0.012		
11	0.08			0.012		
12	0.08			0.012		
13	0.08	0.1		0.012		
14	0.08	0.1		0.012	0.017	
15	0.08	0.1		0.012	0.017	
16	0.08	0.1		0.012	0.017	
17	0.08	0.1		0.012	0.017	
18	0.08	0.1		0.012	0.017	
19	0.08	0.1	0.09	0.012	0.017	0.047
20	0.08	0.1	0.09	0.012	0.017	0.047
21	0.08	0.1	0.09	0.012	0.017	0.047
22	0.08	0.1	0.09	0.012	0.017	0.047
23	0.08	0.1	0.09	0.012	0.017	0.047
24	0.08	0.1	0.09	0.012	0.017	0.047
25	0.08	0.1	0.09	0.012	0.017	0.047
26		0.1	0.09		0.017	0.047
27			0.09			0.047
28			0.09			0.047
29			0.09			0.047
30			0.09			0.047
31			0.09			0.047

TRANSITION

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